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ABSTRACT

Described is the Del Mod System, its inception, the fundings associated with it, and its objectives. A number of projects have already been completed and implemented. This monograph describes the evaluations of such projects and of the Del Mod systems-approach to science education. The area of evaluation and the method of data collection (with guidelines listed) are described. Problems of the System's evaluation are noted. These include lack of financial resources, inadequacy of some designs, and public apprehension about research. References are cited. (EB)

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RESEARCH AND EVALUATION WITHIN THE DEL MOD SYSTEM

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RESEARCH AND EVALUATION WITHIN THE DEL MOD SYSTEM

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March, 1972

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BACKGROUND

A Systems-Approach to Science Education was created in 1971 to serve as an integrative agency representing the Delaware Department of Public Instruction, the University of Delaware, Delaware Technical and Community College, and Delaware State College. It has been jointly funded by the National Science Foundation, the State of Delaware, and the Du Pont Committee on Educational Aid, each of which has made a five-year commitment to the systems-approach. At the end of that time the various components are expected to assume appropriate responsibility for Del Mod functions.

The Del Mod System is the first systems-approach to an educational problem ever funded by N.S.F. because there were several salient features in the Del Mod proposal of 1970 which appealed to them. One was the integrative nature of the systems-approach, which, if successful, will coordinate science-education activities of several highly autonomous institutions in Delaware. The potential for increased fiscal and intellectual efficiency was evident to N.S.F. and to many educators in the state.

Another advantage of the Del Mod System will be its relative stability as a five-year project. N.S.F. traditionally funded one-year projects and proven performers were frequently refunded. Occasionally, this method of funding was criticized because it prohibited development of long-range projects and long-range evaluation. And to some extent, it also prohibited the development of integrative projects.

The primary objective of the Del Mod System is to increase the scientific literacy of children in Delaware schools through improved training of their teachers. A number of projects have already been implemented or designed to meet that objective. The evaluations of such projects and of the Del Mod systems-approach to science-education are the subjects of this paper.

AREA OF EVALUATION

Evaluation undertaken by Del Mod should accomplish several specific goals: there must be a body of baseline data describing teachers, students, and schools in Delaware. These data will affect the evaluation of each project, each component institution, and the Del Mod System itself.

Each project funded within the System should be evaluated. Since some project directors may have questions about evaluation, the Research Director will assist in the development of both short range and longitudinal studies to measure the impact of the projects upon the students of teachers involved therein.

Needs assessment should be conducted throughout the five year duration of the System. Agents are being sent into the schools to assess needs, conduct research, and disseminate Del Mod findings. These agents are expected to develop sound professional recommendations about future Del Mod programs.

Concomitant with these activities, a sociological evaluation of the Del Mod organizational structure and its components should be conducted to ascertain lines of communication, degree of commitment, sources of power, and areas of weakness both within and external to the System. These evaluations will pinpoint potential weaknesses in the communication flow and reveal constraints in the System itself.

Finally, a panel of consultants should convene periodically to ask, "Is Del Mod doing what it set out to do?", "Is the payoff on each project worth the expense?", and, "Are the right variables being measured and are the analyses appropriate?" The Del Mod System should redirect its flow of resources and/or should redesign its plans, if necessary, to meet newly demonstrated needs.

COLLECTION OF DATA

The collection of baseline data was begun in August, 1970, one year before the official beginnings of the Del Mod System. At that time a detailed study into the background and preparation of Delaware secondary school science teachers was undertaken by the author. Three hundred and eighty teachers were surveyed, the college transcripts of each were analyzed, and the Test on Understanding Science (TOUS) was administered. All of the resultant data were computer analyzed and forwarded to N.S.F. as *The Annual Report of the Del Mod Research Director*[1] in August, 1971.

Student data were somewhat harder to collect. There was little time to plan a testing program in the 1970-1971 school year, but the TOUS was administered to over 1000 seniors from several high schools in the state. During the 1971-1972 school year fourth, eighth, and twelfth grade students have been given science achievement tests. The Department of Public Instruction in Delaware has tested the fourth and eighth graders using a test developed for Delaware by Educational Testing Services, Princeton, New Jersey. This test, based on items from the STEP tests, will be analyzed by the Del Mod System during the month of June, 1972. Seniors in five randomly selected high schools were administered a modified version of the National Assessment Test. This test is currently being analyzed by the Del Mod System along lines similar to those in the report of the National Assessment.[2]

Project evaluation has been undertaken by the individual project directors along guidelines suggested by the Del Mod System.

These guidelines are reproduced below:

"Programs funded under the aegis of the Del Mod System should be quantitatively and qualitatively evaluated. The reasons for this are manifold: the taxpayer

deserves to know what his money is doing; private industry, NSF, and the State of Delaware will expect professional appraisals of programs they have sponsored; and the inevitability of evaluation will tend to upgrade the various programs.

"Evaluation should be consistent with the eleven guidelines from pages 6 and 7 of the Del Mod System Fiscal Procedures and Reporting Manual.[3] Thus, the proposal should include:

1. Objectives of proposed project in behavioral terms
2. A description of the target population as fitting the priorities of the Del Mod System.
3. A brief summary of proposed activities high-lighting any new or special features
4. A PERT Chart of activities
5. An evaluation design
6. A description of leverage, including any additional sources of support and letters of commitment from cooperating schools, if applicable
7. A description of efficiency as part of assessing the input of the project on improving the quality of education without increasing costs
8. A description of systemization as it leads to the establishment or enhancement of a mutually reinforcing relationship between the Del Mod System and the local schools
9. A description of residual impact indicating how activity will be supported or phased into normal operation after support is terminated
10. Any changes which might arise which might affect preservice education, if applicable
11. A budget relating to activities with all funding sources shown

"The fifth guideline 'evaluation design' should be interpreted to mean statistical design for measuring the progress of the target population. Pre- and post-experi-

mental measures should be planned for every Del Mod program. Hard evidence will be an invaluable tool in explaining and accounting for success (or failure) of the various programs. The various funding agencies have indicated that they will not settle for less.

"The proposal writer should suggest the best methods for evaluating his own program. To insure objectivity the research design should be reviewed carefully by the component coordinator and the Research Director of the Del Mod System. No proposal should be funded without an acceptable plan for statistical evaluation.

"The final report for each funded project should be statistically supported so that any replication of the project will have an equal (or better) chance of succeeding in another community."[4]

Two agents have been visiting each school in Delaware to assess the status of science education. Approximately 150 science teachers will be videotaped by the end of the 1971-1972 school year, and the science facilities of each school will be evaluated by these agents. Following the analysis of the videotapes, the tapes will be stored as part of the body of baseline data. Two researchers are currently employing the Flanders-Amidon Interaction Analysis Technique to evaluate the styles of teaching exhibited on the tapes. Their analyses will constitute doctoral dissertations for Temple University and the University of Texas, respectively.

The sociological evaluation of the Del Mod System is deemed necessary if the systems-approach is to be adopted elsewhere. The political problems which must be overcome to insure the interrelationship of schools, colleges, and a department of public instruction are many and varied. After these are resolved, the intellectual problems of improving science-education can be dealt with. To date, a study of this nature has not been conducted.

External evaluations of the Del Mod System proposals are conducted by the National Science Foundation as each annual supplemental budget request is submitted. This procedure does not provide detailed review of Del Mod projects. Evaluation techniques should be assessed by a panel of consultants trained in educational research methods, and suggestions for more comprehensive studies could be planned in cooperation with the outside review team.

PROBLEMS OF SYSTEMS EVALUATION

The Del Mod System was preceded by serious study and data collection which justified the development of a system and the support for the initial projects. Many of these recent studies are now considered outdated or inadequate in scope.

In retrospect, much of the early rationale for the System and its projects was based upon intuition and expediency. For example, Purnell[5] demonstrated many of the weaknesses in science education in Delaware schools. This study agreed with surveys conducted by scholars elsewhere, i.e., that junior high schools and elementary schools needed the greatest amount of attention to effect good science education. The conclusions of Purnell's study were based upon survey data and subjective data; they were intuitively pleasing; and, they received a broad base of attention and support in Delaware.

When the Del Mod System became viable in July, 1971, new questions became evident, and some of them are difficult to answer with the initial research resources and limited funds. Testing student achievement, for example, is costly and is relevant to Del Mod needs and goals. The Department of Public Instruction, which has the responsibility for student testing in Delaware public schools, has the resources necessary for adequate evaluation and tested science achievement for grades 4 and 8

in the Spring of 1972. The testing plan needs to be extended to other grade levels and the information fed back to the schools for planning purposes.

Another problem has been the skepticism which many educators have of research and evaluation. This is true even where the advantages of research are obvious. In Delaware, the research which has been conducted in the past has not always been conducted responsibly, nor have the results of the research been adequately shared with, or explained to, the subjects of that research. The Del Mod System has engaged in a policy of (1) outlining each phase of the evaluation procedures with each project director and teacher involved in research, (2) confidential treatment of all data collected, and (3) sharing data only with the subjects of the research. This policy is time-consuming, but its advantages should compensate the System by increasing the willingness of participants to cooperate in the research endeavor.

SUMMARY

This monograph presents a review of the basic plan for conducting research and evaluation within the Del Mod System: Systems Approach to Science Education, which is currently in its first year of operation in the state of Delaware. The plan includes an outline of baseline data collected, evaluation designs for the various projects and components of the System, and future evaluations which must be considered if the systems-approach is to be replicated elsewhere.

In addition, some of the problems of research within the System are discussed. These include lack of financial resources, inadequacy of some designs, public apprehension about research, and some tactics which are being attempted to overcome these shortcomings.

A systems-approach to education is an idea which is complex, yet simple. The pooling of resources to solve an

educational problem by colleges, universities, state departments of public instruction, and the schools themselves is an idea worthy of consideration by others. It has afforded Delaware many economies, a large amount of inter-institutional communication, sharing of purpose, and educational innovations. It is too early to assess the intellectual benefits the approach has for the children in Delaware schools. This assessment cannot be completed until the termination of the Del Mod project several years from now.

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